HXr Graphical Engine Display Setup Manual

Revision A

04-Nov-2013

Section 1: HXr Graphical Engine Display Layout

1.1 Introduction

When connected to a Grand Rapids Technologies EIS (Engine Information System), the HXr is capable of displaying a multitude of engine and environmental parameters. Two suites of systems information are presented on the Home screens, along with configurable Engine inset windows and a dedicated Engine/Moving Map split-screen designed for multi-display systems.

This section of the manual covers basic arrangement and configuration of the graphical engine display on the HXr. Please refer to the EIS manual and individual probe wiring diagrams, supplements and information sheets for wiring and configuration of your EIS system and probes.

1.2 Working with the GRT Engine Information System (EIS)

A GRT EIS (Engine Information System) is required to gather most of the engine and systems data. The EIS is the computer that gathers information from all of the sensors and probes and feeds it into the HXr. The EIS is connected to the HXr through one of the serial ports.

Some sensors have the option of being wired directly to the EFIS system. For example, fuel level probes can be connected directly to the HXr using the Analog inputs. Outside Air Temperature (OAT) can be wired directly to the AHRS or the EIS.

Blind-Mounting the EIS

The EIS does not have to be mounted to the instrument panel face. Due to the size of the HXr, many builders choose to mount their EIS in a tucked-away location that is accessible only for initial programming. Because warnings on the EIS can not be canceled in flight if the unit is out of pilots' reach, the HXr is programmed with all of the engine limits, and the EIS limits are set to "0," with few exceptions. The EIS will send all of the raw sensed data to the HXr, which then detects any out-of-limit parameters and displays a warning for the pilot. Warnings on the HXr are acknowledged by pressing the yellow MSG softkey.

Monitoring Oil Pressure at Engine Start

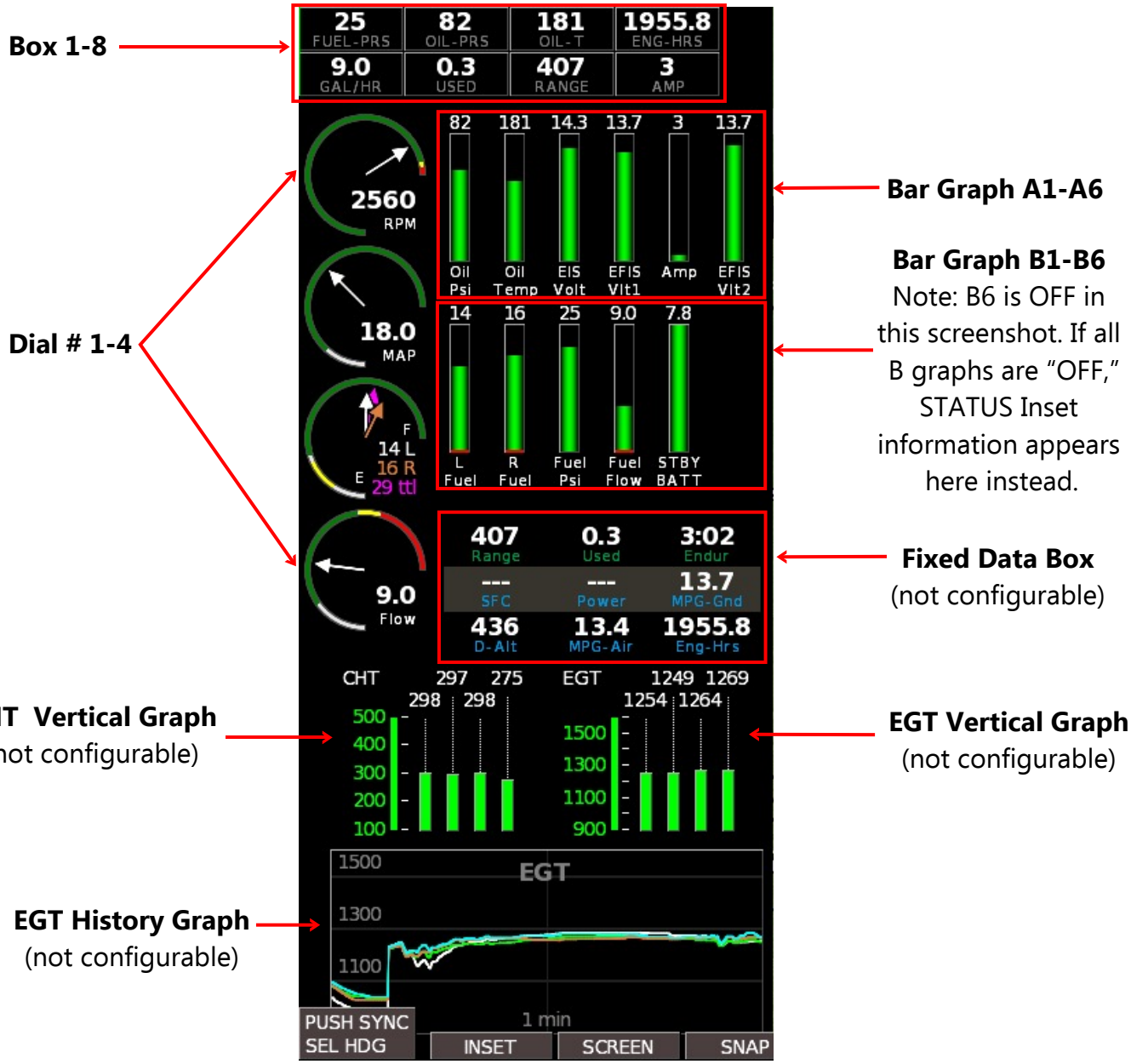
The HXr should not be wired to the master circuit because of possible current spikes during engine start. However, the EIS will not be bothered by these spikes and should be wired to the master for the sole reason of showing an oil pressure reading during engine start. The minimum oil pressure limit should be set in the EIS regardless of whether the unit is blind-mounted. A simple warning light can be wired to the EIS and placed on the instrument panel to monitor oil pressure before the HXr is booted up.

1.3 Home Screen Engine Layout

There are several configurable areas of engine and systems information on the map and PFD Home screens, as shown below. The right side of the screen is omitted for clarity.

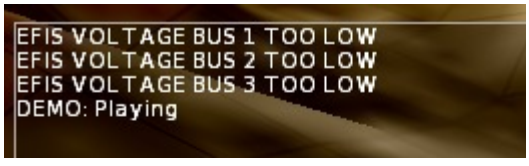
1.4 ENG/MAP Home Screen Layout

The Graphical Engine Display set menu page lists several groups of data boxes, graphs and dials. Use the image below as a guide when programming them so you know where they will appear. The dials are numbered from top to bottom, while the graphs and boxes are numbered from left to right.



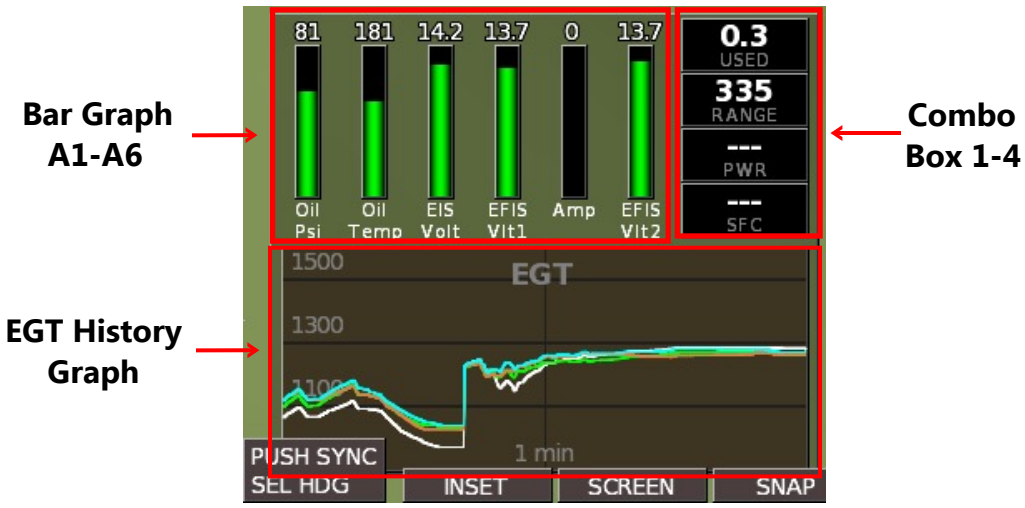
1.5 Engine Inset Window Options

Press INSET > ENG/STAT softkeys to access choices for the Engine Inset windows, described here. "CHECKLIST" is also a choice; see HXr Pilot's Guide for more information on creating custom checklists for your aircraft.



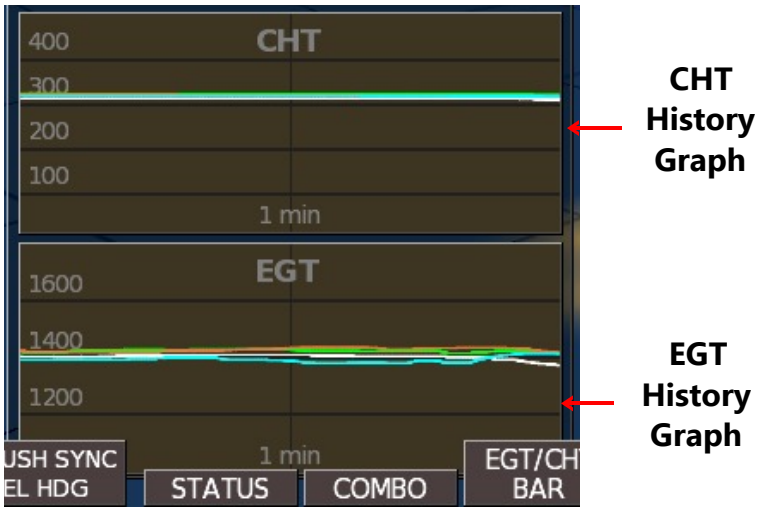
STATUS: The Status inset provides a textual list of any warnings or errors picked up by the HXr or EIS.

COMBO Inset: A mix of graphs and data boxes including the EGT history line graph, Bar Graph A1-A6, and the Combo Boxes. The Combo Box fields have the same choices as the Box 1-8 data fields, but are shown only in the Combo Inset window.



EGT/CHT BAR Inset: Displays the EGT history graph accompanied by the EGT and CHT bar graphs. Very useful for Lean Assist mode, as leaning can easily be accomplished with the PFD in full view. Press INSET>ENG/STAT>LEAN for Lean Assist.

EGT/CHT History Inset: Displays the CHT History Graph above the EGT History Graph. The EGT line graph is often overlooked, but it is very useful for instantly noticing EGT trends which can signal the beginning of a plugged injector, stuck valve, or other cylinder-specific engine malfunction.



Section 2: Choosing Engine & Systems Data to Display

2.1 Displaying Engine Information on the HXr

There are 53 engine and systems data sets to choose from for the Graphical Engine Display. This might seem like a daunting number, but you will not use them all. They are all there to accommodate a wide range of engines and airframes. Some choices, such as N1/N2, TIT and Torque, are available for turbine engines. Others, such as Air Pressure, are available for aircraft with pneumatic systems.

This section provides you with some tools to decide which engine and systems data sets to display and where to put them. The table lists all of the choices for the Graphical Engine Display and where they can be displayed on screen. It also includes part numbers and/or descriptions of the sensors required to collect and display the information. All of the sensor part numbers listed are available from GRT. Some sensors may be provided with your engine, and some engines may require a different type of sensor. If your engine requires a type of sensor not listed here, give us a call. The reason we offer such a large list of options is because our customers are always asking for expansion of our software and hardware to include more sensors and information.

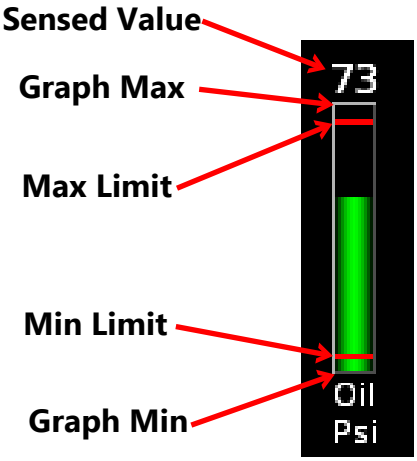
Your engine/systems layout will depend heavily on the type of engine you have and the type of flying you will do. Use the worksheet in Section 2.2 to lay out the data fields that work best for you. The table presented in 2.3 lists all of the data sets, along with the places they can be located.

TIP: Fields shaded in gray in the table are always shown on the ENG/MAP home screen in the Fixed Data Boxes. Because they are always present, you may choose not to redundantly display them in the programmable data fields. If the sensors required are not installed, these values are shown as a horizontal dashed line.

2.2 Sequence for Setting Up the Graphical Engine Display

Because some menu options are activated by other menu options, follow this sequence to set up your Graphical Engine Display. It will save some time and eliminate some page flipping in the Set Menu.

1. Gather documentation for your engine limitations, electrical system, fuel system, and EIS wiring. During this process, you will program the limits for the graphs and dials, as well as configure the HXr to match the EIS auxiliaries.



2. Press MORE > Set Menu > Graphical Engine Display. Scroll down past the Dial settings. Set the minimum and maximum values for the various bar graphs listed that apply. These numbers represent the "Graph Max" and "Graph Min" as shown to the right, and should normally be set a little bit above and below the absolute limits. You will set the limits later on.

3. Continuing down the Graphical Engine Display page, you will see the Aux Functions. **These must match the Aux functions wired and programmed into the EIS.** Set each applicable Aux function source and decimal/integer setting to match your EIS wiring and setup. Set the Graph Min and Max levels for these as well. Data provided by EIS Aux functions will not show up as a choice for the Dials until this step is complete.

4. Finish up by setting up the other graphs listed on the page. If they will not be used, set "0" for each limit. SAVE YOUR SETTINGS!

5. Use the diagrams and worksheets in the next section of this supplement to choose the functions for the various Bar Graphs, Boxes, and Dials. Assign the graphs and dials on the Graphical Engine Display page, starting with the **Dials**, and work down to **Bar Graphs A & B, Boxes 1-8 and Combo Boxes**. Unused graphs, boxes and dials should be set to OFF so they will not appear on the screen.

   NOTE: If all Bar Graphs in the B block are "OFF," the STATUS box appears instead on the ENG/MAP page. See Inset description in Section 1.5 of this manual for more information on the STATUS box.

6. SAVE YOUR SETTINGS!!

7. Press MORE > Set Menu and scroll to Engine Limits. Get out your engine documentation and set up all of the limits for the dials and graphs. This sets the Max and Min Limits as illustrated above, as well as the colored bands on the Dials. When each parameter exceeds the maximum or fails to meet the minimum limits set on this page, the graph, dial or box will flash red and a message will appear that describes the problem. SAVE SETTINGS when finished.

8. If you have a Manifold Pressure sensor (MAP-01 or MAP-02), scroll to **Engine Performance** and press the knob to bring up the performance table. Fill in the horsepower and change-in-horsepower (delta) values in the table according to your engine documentation. This will enable the HXr to calculate Percent Power and Specific Fuel Consumption (SFC). If you do not have original documentation for your engine, there are some performance tables for common engines on the EIS Documentation section of the GRT Avionics website.

Engine Performance

▶ Rated Horsepower: 180

	Sea Level Performance		Altitude Performance	
RPM	55% MAP	75% MAP	Altitude	Delta HP
2000	21.6	26.7	2000	2.3
2100	21.0	26.0	4000	4.6
2200	20.3	25.2	6000	6.9
2300	19.8	24.6	8000	9.1
2400	19.2	23.9	10000	11.4
2500	18.9	23.5	12000	13.7
2600	18.6	23.2	14000	16.0
2700	18.2	22.7		

9. If you haven't already, fill in the **Fuel Data Scales** table to calibrate your fuel gauge indications. See the Resistive Float Senders Supplement for Horizon, also available on the GRT website under EIS Documentation.

10. This is a great time to backup all of the EFIS settings onto a memory stick.

NOTE: We do not recommend using the Backup Settings feature to program Engine Limits and Graphical Engine Display in a second or third EFIS because it will overwrite ALL settings in the display unit. Usually it will cause some critical settings such as serial port assignments to be overwritten and cause more work than it saved.

To backup EFIS settings:

a. Insert the USB thumb drive into the display unit.

b. Go to SET MENU > DISPLAY UNIT MAINTENANCE.

c. Right at or near the top is **EFIS Settings Backup.** Highlight this and push the knob.

d. Highlight **Backup All Settings** and push the knob. Answer YES at the prompt. The system will back up all the display unit's settings onto the USB drive.

e. If it ever becomes necessary to restore your settings, use the **Restore All Settings** option.

2.2 Data Sets and Location Options

Each "x" marks a location that the Data Set can be displayed. Gray shaded data sets are always visible in the Fixed Data Box on the ENG/MAP screen. Sensors listed may not apply to all engines.

Data Set	Dials	Bar Graphs A/B	Box 1-8/ Combo	Fixed Data Box	Required Sensor(s)
Air Pressure	x	x	x		Included w/ Engine
Amp	x	x	x		CS-01 or CS-02 Current Sensor
Amp2	x	x	x		
Carb Temperature	x	x			CARB-01
CHT 1	x				CHT-XX-01
CHT 2	x				CHT-XX-01
Coolant Temperature	x	x	x		FT-1827-02
Density Altitude			x	x	OAT-Included w/EFIS
EFIS Power Bus 1 Volts	x	x	x		N/A- Internal
EFIS Power Bus 2 Volts	x	x	x		N/A- Internal
EFIS Power Bus 3 Volts	x	x	x		N/A- Internal
EGT 1	x				EGT-XXX-01
EGT 2	x				EGT-XXX-01
EIS Volts	x	x			N/A- Internal
Engine Hour Meter			x	x	See "RPM"
Fuel (Combined)	x				Fuel level senders + FF-EI-FT-60
Fuel Economy-Air			x	x	FF-EI-FT-60 + GPS
Fuel Economy-Ground			x	x	FF-EI-FT-60+ GPS
Fuel Endurance			x	x	FF-EI-FT-60
Fuel Flow	x	x	x		FF-EI-FT-60
Fuel Flow-Fuel Remaining	x	x	x		FF-EI-FT-60
Fuel Level (L, R, Center)	x	x			Fuel level senders
Fuel Pressure	x	x	x		LPS-02
Fuel Range			x	x	FF-EI-FT-60
Fuel Used			x	x	FF-EI-FT-60

NOTE: Any monitored parameters that are exceeded will show up as a flashing warning box regardless of the engine instruments currently displayed, so it is not critical to see all engine indications at all times.

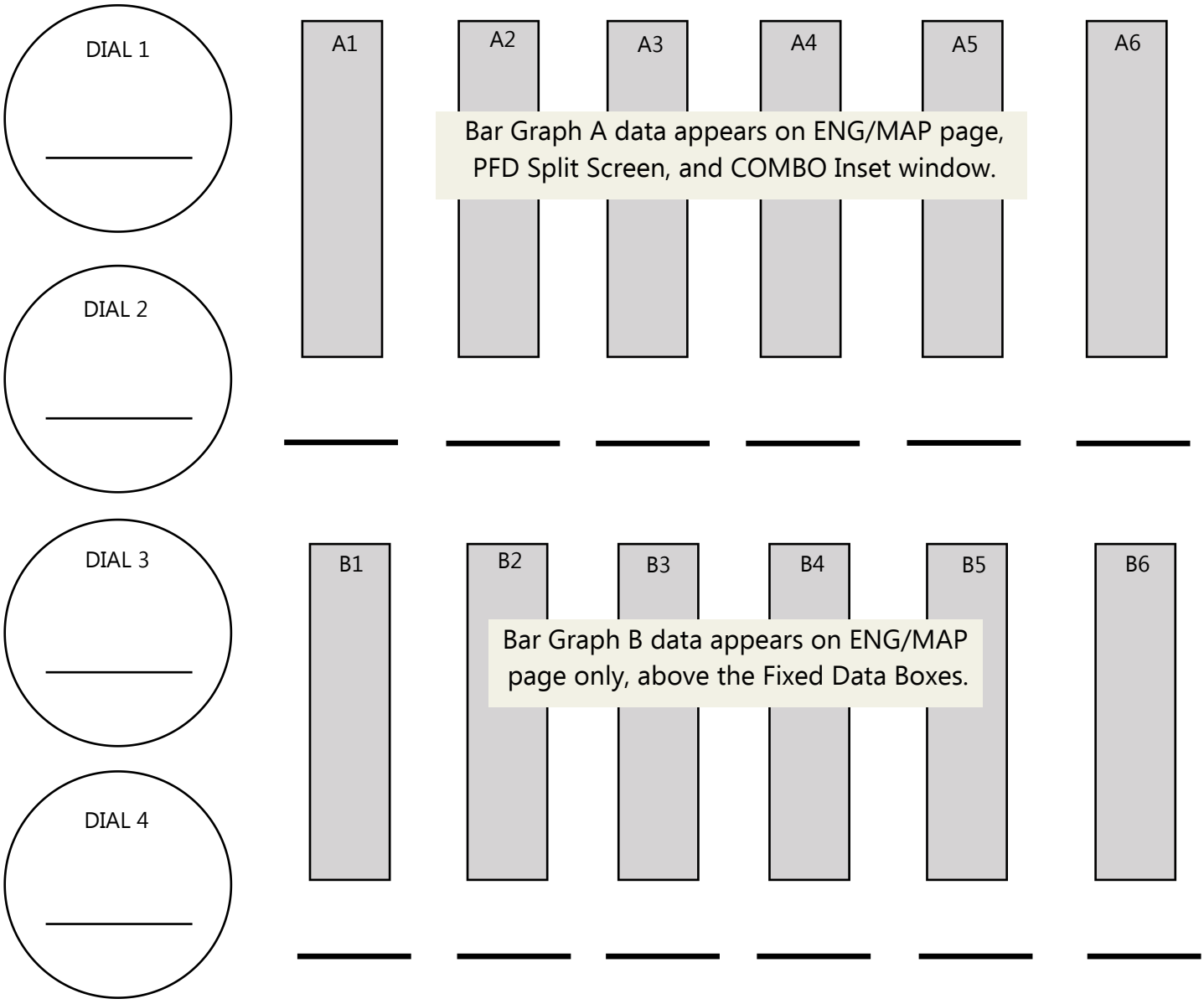
Data Set	Dials	Bar Graphs A/B	Box 1-8/ Combo	Fixed Data Box	Sensor Required
Gear Box Temperature	x	x	x		FT-1827-02
Highest CHT	x	x			CHT-XXX-01
Highest EGT	x	x			EGT-XXX-01
Highest TIT	x	x			EGT-HCSLL-01
Hydraulic Pressure 1	x	x	x		HPS-2500
Hydraulic Pressure 2	x	x	x		
MAP (Manifold Pressure)	x		x		MAP-01 or MAP-02
N1	x		x		Included w/ Engine
N2	x		x		
N3	x		x		
Oil Pressure	x	x	x		HPS-01 or HPS-02
Oil Temperature	x	x	x		FT-LC-01
Percent Power	x		x	x	MAP-01 or MAP-02
RPM	x		x		Typically uses magneto P-lead
RPM2	x		x		
RPM3	x		x		
SFC (Specific Fuel Consumption)			x	x	MAP-XX + FF-EI-FT-60
TIT1	x				EGT-HCSLL-01
TIT2	x				EGT-HCSLL-01
Torque	x		x		Included w/ Engine
VP-200 Aux Batt Volt		x			Vertical Power VP-200 electronic circuit breaker system. Other Vertical Power models have their own status page on the EFIS.
VP-200 Bus A AMP		x			
VP-200 Bus A VOLT		x			
VP-200 Bus B AMP		x			
VP-200 Bus B VOLT		x			
Water Pressure	x	x	x		LPS-02

2.3 Data Boxes & Dials Layout

You may fill in the blanks to help plan your layout. See Appendix for sample layouts.

BOX 1	BOX 2	BOX 3	BOX 4
BOX 5	BOX 6	BOX 7	BOX 8

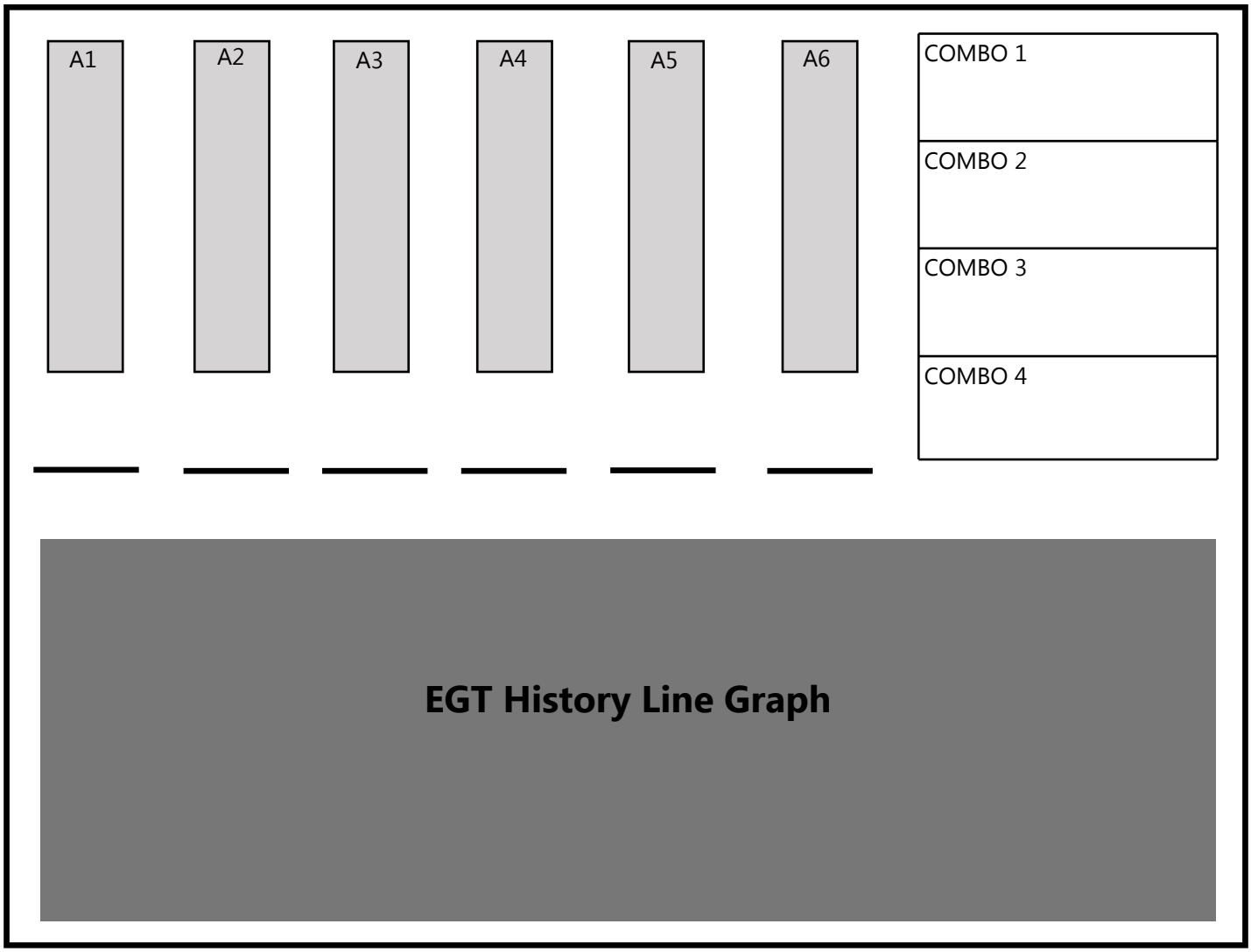
- **Data Boxes 1-8** (left) appear on all PFD screens, the MAP home screen, and ENG/MAP home screen.
- They do NOT appear on the MAP/CHART screen.



- **Dials 1-4** (above) appear on the PFD home screen, the PFD Split screen (across the bottom), and the ENG/MAP home screen. They do NOT appear on the MAP or MAP/CHART home screens.

On the ENG/MAP screen, the Fixed Data Boxes, CHT and EGT Bar Graphs, and EGT Time History line graph appear BELOW the configurable fields shown here.

NOTE: Any monitored parameters that are exceeded will show up as a flashing warning box regardless of the engine instruments currently displayed, so it is not critical to see all engine indications at all times.

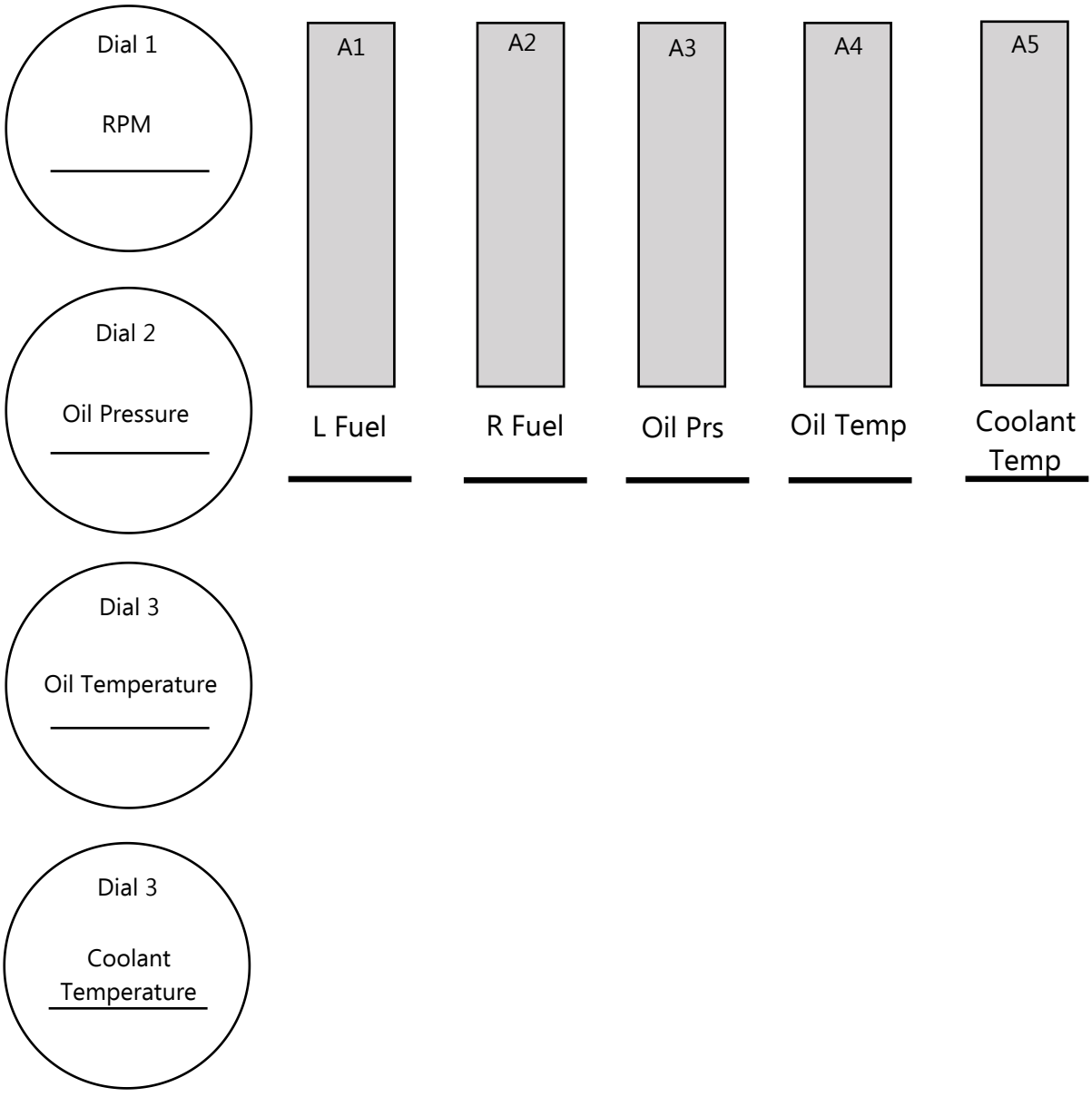


The only customizable inset is the Combo, shown here enlarged for clarity.

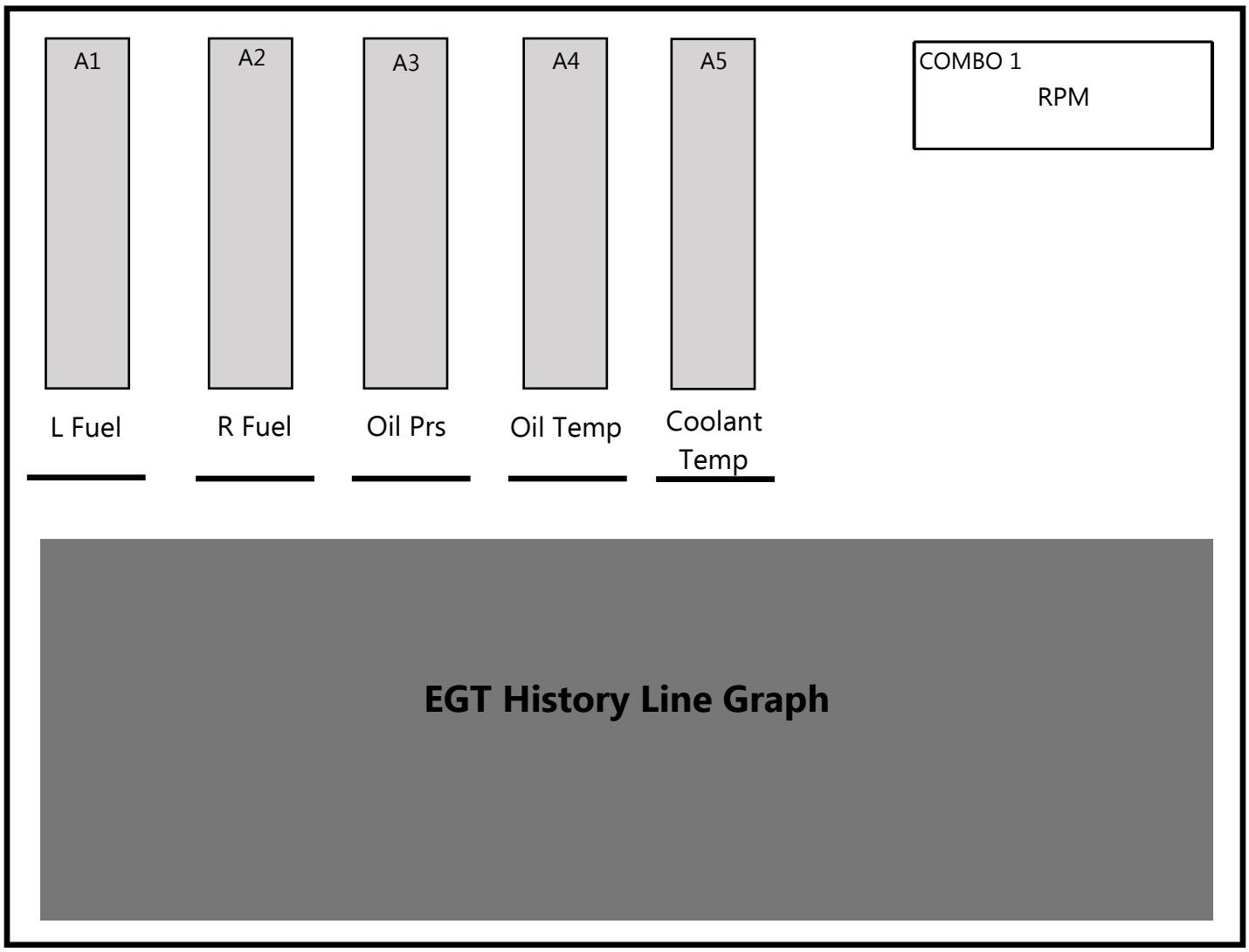
Sample A- Carbureted/fixed pitch, liquid cooled, VFR with Basic EIS Package

When configurable data boxes are set to OFF, they simply disappear off the screen.

BOX 1 EFIS Power Bus 1 Volts	BOX 2 EIS Volts
BOX 5 Engine Hourmeter	BOX 6 Density Alt



Bar Graph A

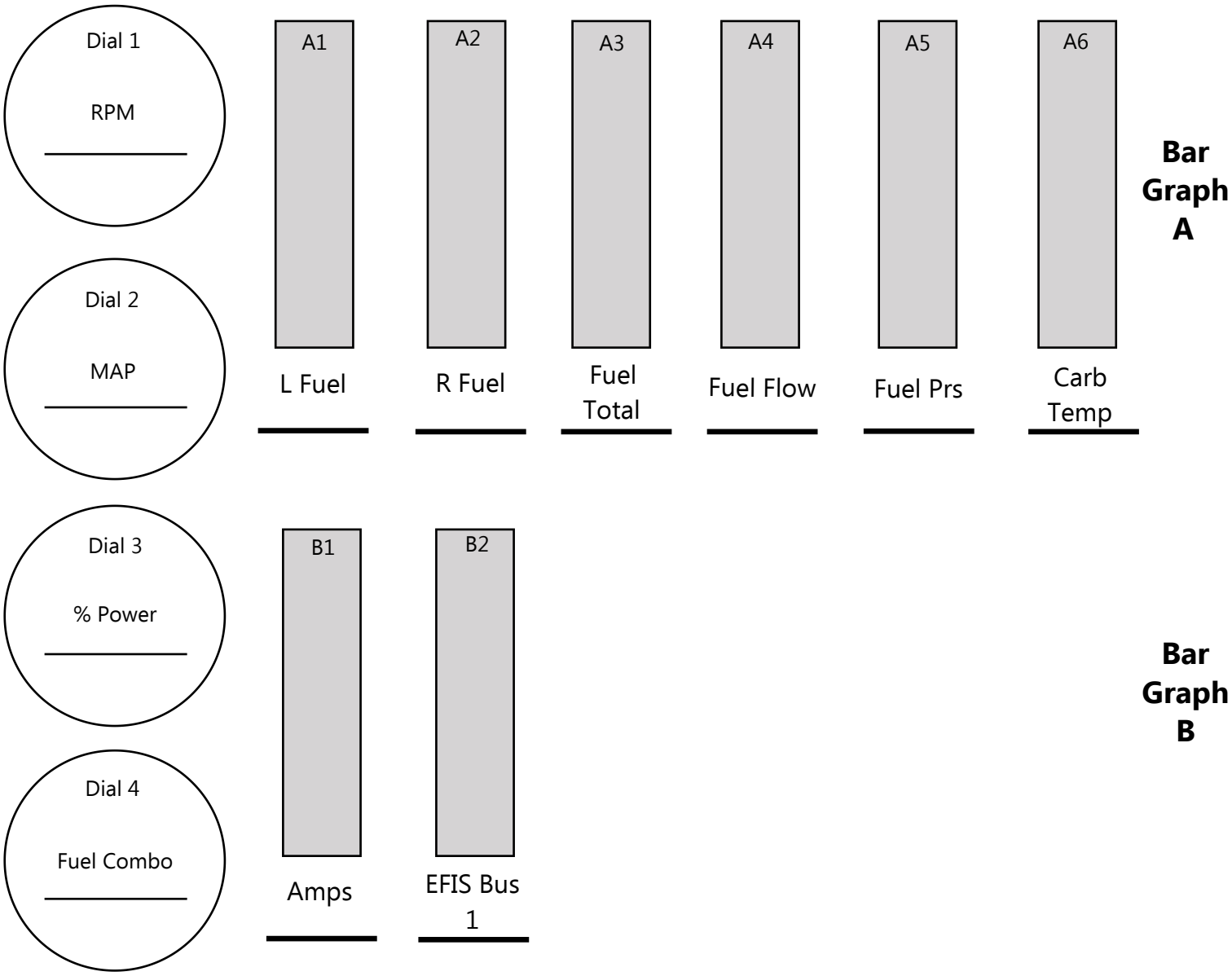


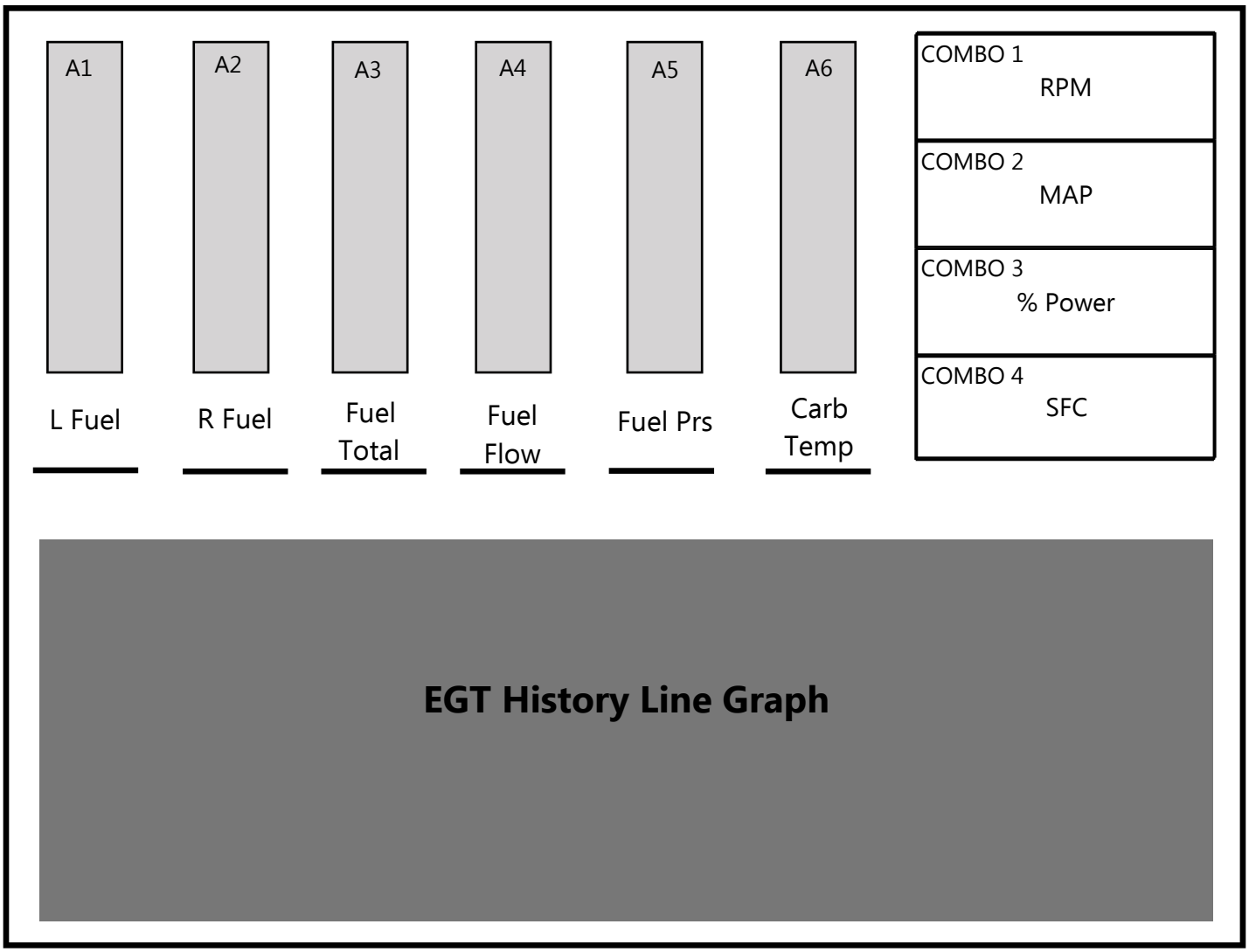
Sample Combo Box Inset, enlarged for clarity. This inset is set up to offer a redundant view of the important engine controls featured by the Dials in the Combo fields. It will be most useful on the full-size Map screen, which does not show the Dials.

Sample B- VFR, Advanced Lycoming/Continental EIS package + Carburetor Temperature

BOX 1 Amps	BOX 2 Oil Pressure	BOX 3 SFC	BOX 4 Fuel Flow
BOX 5 EFIS Power Bus 1 Volts	BOX 6 Oil Temp	BOX 7 Carb Temp	BOX 8 Density Alt

- **Data Boxes 1-8** (left) appear on all PFD screens, the MAP home screen, and ENG/MAP home screen.
- They do NOT appear on the MAP/CHART screen.



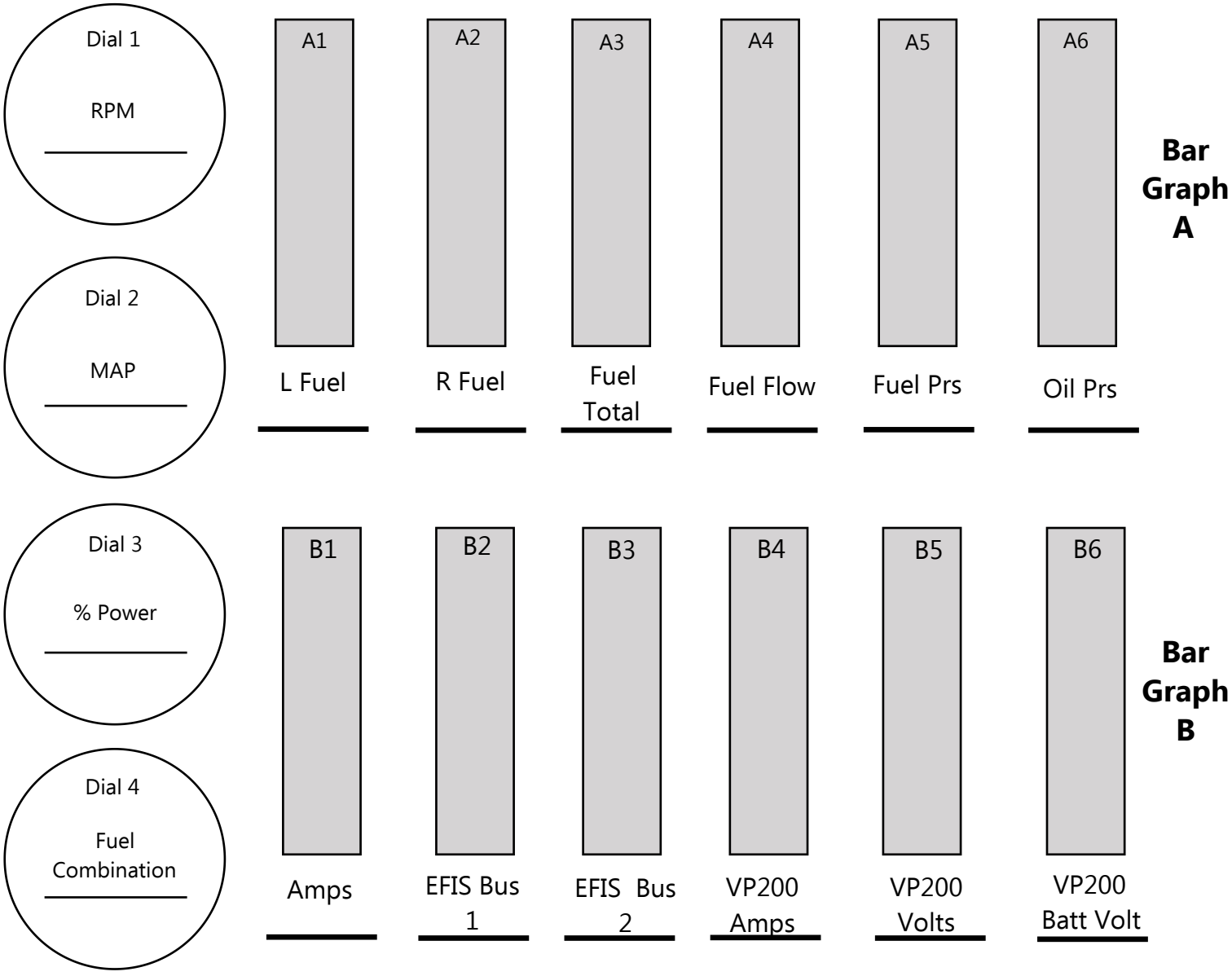


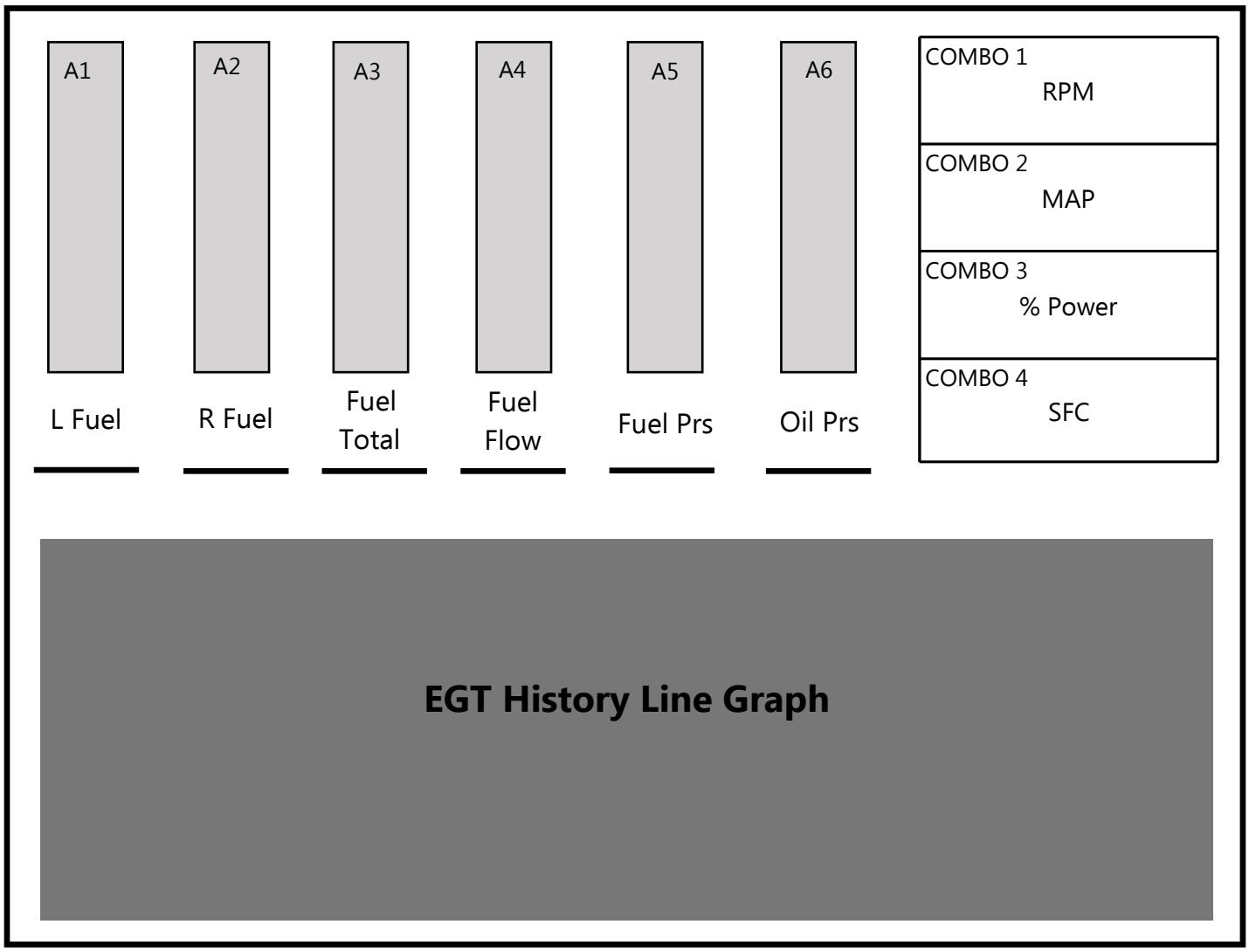
Sample Combo Box Inset, enlarged for clarity. This inset is set up to offer a redundant view of the important engine controls featured by the Dials in the Combo fields. It will be most useful on the full-size Map screen, which does not show the Dials.

Sample C- IFR, Lycoming/Continental Advanced EIS package, constant-speed prop with Vertical Power electronic circuit breaker system

BOX 1 Amps	BOX 2 EFIS Power Bus 1 Volts	BOX 3 Oil Pressure	BOX 4 Fuel Flow
BOX 5 Engine Hourmeter	BOX 6 EFIS Power Bus 2 Volts	BOX 7 Oil Temp	BOX 8 Density Alt

- **Data Boxes 1-8** (left) appear on all PFD screens, the MAP home screen, and ENG/MAP home screen.
- They do NOT appear on the MAP/CHART screen.





Sample Combo Box Inset, enlarged for clarity. This inset is set up to offer a redundant view of the important engine controls featured by the Dials in the Combo fields. It will be most useful on the full-size Map screen, which does not show the Dials.